APPARATUS FOR VENTING OF PROTECTIVE PANELS FOR ORNAMENTAL WINDOWS

This application claims the benefit of U.S. Provisional Application No. _____ filed October 4, 2002.

Background of the Invention

Field of the Invention

The present invention relates in general to providing means for adequate ventilation for protective panels or covers used for protecting ornamental windows such as stained glass.

Description of the Prior Art

Ornamental windows, such as stained glass windows, represent an expensive investment for an individual or institution. These windows are typically on the exterior of buildings and as such are exposed to moisture, wind, excessive heat and vandalism. Repair of such windows can represent an enormous expense.

It is therefore common to employ protective panels for such windows, to not only protect the ornamental window from damage, but to provide an insulating or thermal barrier for the ornamental window. A protective covering is described in U.S. Pat. No. 5,993,925. Typically these protective coverings which are sometimes referred to as protective glazing, cover the ornamental window pattern in such a fashion that it corresponds to the window's geometric shape. These protective coverings or panels can comprise a wide diversity of transparent materials such as clear or tempered glass, acrylic, polycarbonate, as well as laminated or thermopane glass. These panels typically

provide an airspace between the panel and ornamental window to provide a thermal barrier.

Unfortunately, the use of these panels often actually results in unintended and accelerated damage. It is not uncommon for these panels to be added without adequate ventilation. This allows the airspace created between the panel and window to cycle between superheated high temperatures and low temperatures relative to sun exposure. This constant cycling between high and low temperature in the airspace damages leaded stained glass windows by metal fatigue which weakens the leaded seams between the glass sections of the stained glass window. Moisture that may also inadvertently be trapped in the airspace represents a threat to the stained glass appearance, allows bacteria and microorganisms to multiply and damage the cemented portions, and accelerates the deterioration of the leaded joint. Non vented protective panels act as a solar box, cycling temperatures between 165 and 5 degrees Fahrrenheit and leaving the temperature at or near dewpoint for longer periods of time than would otherwise occur. Because of the various materials in the window i.e. glass, lead, wood and their respective and varied expansion coefficients, this temperature swing over time weakens the structure allowing bowing, weakening, and cracking.

It is therefore common for installers of these protective panels to drill holes in portions of the panel to provide some degree of air exchange with the exterior air. These holes however, reduce the aesthetic value of the protective panel and, for the most part, do not provide an adequate source of ventilation for the airspace. In addition, without some sort of filter device, these holes allow moisture, insects and debris to enter the space between the stained glass window and the protective panel. Therefore, this kind of

ventilation does not address the problems posed by heat cycling and moisture between the protective panel and the window.

It is therefore an object of the present invention to provide a means for the ventilation of protective panels for ornamental windows that provides an adequate degree of air exchange with exterior or interior air, to avoid or at least minimize the problems posed by heat cycling and trapped moisture.

It is also an object of the present invention to provide venting means for the airspace between the protective panel and the ornamental window wherein venting means are included in the frame to avoid appearance issues with the cover.

It is a further object to provide venting means which provide directed air flow or air exchange in the airspace.

It is an object to provide venting means which may be included in the frame holding the protective panel and the stained glass window or in a perimeter frame holding just the protective paneling or in other frame elements such as mullions or muntins.

It is an objective of the present invention to provide venting means which adequately prevent moisture in the form of rain water and insects from entry.

These and other objects are achieved by the present invention described below.

Summary

The present invention discloses an apparatus whereby adequate ventilation is provided between a protective panel and an ornamental window such as a stained glass window. This is achieved by providing venting means, preferably comprising at least one entry vent and an exit vent for each entry vent, said vents being of specific dimensions relative to those of the ornamental window. The venting means provide a way for exterior

or interior air to circulate between the protective panel and the ornamental window itself and provide directed air flow in the air space between the panel and window. The direction of the airflow is a result of the air warming upon entry and then rising. The vent openings that are included in said venting means in the frame are connected to reach the airspace between the panel and window. A preferred and typical embodiment of the present invention is to use vent openings in pairs in the frame to provide points of entry and exit, for either interior or exterior air, thereby directing air flow through the air space in such a manner to provide more effective air circulation.

The vent openings of the venting means must be of an adequate size so that effective air circulation in the space is achieved thereby minimizing heat or moisture damage to said ornamental window. Specifically there is recommended at least about 1 square inch of 100% effective vent opening, both entry and exit, for about 2000-2500 square inches of stained glass. Openings for vents that are screened are usually around 60% effective. Therefore, for every square inch of 100% effective open vent required, about 1.67 square inches of screened vents should be used. The effective level depends on screen density and is similarly altered by a ceramic filter, a hood, or any other debris deterring accessory. The present invention meets the objectives stated previously because it meets the general requirements for providing effective openings per area of stained glass and adequately provides airflow between the protective panel and the stained glass. Due to adequate airflow, moisture is removed more quickly, the temperature does not hover near dewpoint for long periods of time creating interior condensation, and the temperature cycles in the range of 35 to 105 degrees Fahrenheit rather than the broader range of 5 to 165 degrees which is typical of inadequately vented panels.

In the preferred embodiment of the present invention, the vent openings of said venting means include a screen to deter insects, debris and water and the vent size used takes into account the effect of the screen density or other air filtering devices that influence air flow, as well as the cross sectional areas of any passages or openings through which the air will flow. In the preferred embodiment, the venting means include a vertical portion of a passageway which acts to prevent rainwater from entering the air space between the protective panel and the window.

It is not uncommon in ornamental window design that mullions or muntins are included. A mullion is the vertical element that separates the lancets of a window whereas a muntin is usually a horizontal element that separates or divides glass. These elements are included for geometric appeal and it is equally apparent that in such windows, venting means of the present invention can also be included in these mullions or muntins, provided that they are connected with the inner airspace between the panel and window.

In one modification of the preferred embodiment, venting means are included in a frame which holds both the protective panel and the stained glass window. The venting means facilitate entry and exit of air flow in airspaces created between the stained glass, the protective panel, and the frame boundaries. Venting means can also be positioned in the mullions or muntons as described above. In the preferred embodiment, venting means comprise vent openings the sizes of which are governed by the same mathematical relationship as previously described to achieve adequate and efficient air flow.

In a second modification of the preferred embodiment, the protective panel is placed in a perimeter frame which is spaced apart from the original stained glass and its

structural components. Venting means are included in the perimeter frame thereby bypassing the need for vents in mullions or muntons.

In a third modification of the preferred embodiment, venting means are positioned in a frame which is a replica of the appearance of the original frame so that the aesthetic appearance is preserved while providing adequate venting.

In a fourth modification of the preferred embodiment, venting means are positioned in a casting comprising a vent opening, a path with a cross sectional area, a proximal path, an inside opening, a distal path, and an interior opening, and a closed top end. Each casting is then positioned in a frame as needed for venting purposes. In a situation where it is desired to preserve the original frame, the original frame may be altered such that its ornamental surface remains intact and the casting may be placed behind its ornamental surface with only an appropriate vent opening cut in the ornamental surface of the frame.

Other objects, features, and advantages of the present invention will be readily appreciated from the following description. The description makes reference to the accompanying drawings, which are provided for illustration of the preferred embodiment. However, such embodiment does not represent the full scope of the invention. For example, entry vent openings and exit vent openings may be placed anywhere in the frame as long as an exit vent opening is vertically above the vertical position of an entry vent openings. The subject matter which the inventor does regard as his invention is particularly pointed out and distinctly claimed in the claims at the conclusion of this specification.

Brief Description of the Drawings

Fig. 1 represents a front elevational view of a first modification of the preferred embodiment of the venting apparatus incorporated in a total frame holding both a protective panel and an ornamental window;

Fig. 2 represents a front elevational view of a second modification of the preferred embodiment of the venting apparatus incorporated in a perimeter frame holding a protective panel for ornamental windows;

Fig. 3 shows a cross section of the modification shown in Fig. 1 along line 3-3 illustrating a connection between an entry vent opening and an airspace between the panel and window;

Fig. 4 shows a cross section of the modification shown in Fig. 2 along line 4-4;

Fig. 5 shows a cross section of the modification of Fig. 1 along line 5-5 illustrating a connection between an exit vent and the airspace;

Fig. 6 shows a cross section of the modification of Fig. 2 along line 6-6 illustrating a connection between an exit vent and the airspace;

Fig. 7 is a schematic showing the path of airflow through said venting means;

Fig. 8 shows a front plan view of a frame containing castings of the fourth modification of the preferred embodiment of the venting means;

Fig. 9 shows a front plan view of a frame with a round top and containing venting means of the present invention; and

Fig. 10 shows a front plan of a frame with a gothic top and containing venting means of the present invention.

Description of the Preferred Embodiment(s)

The preferred embodiment of the present invention is shown generally in two modifications in Figs. 1 and 2 and includes the elements of an ornamental window 3, a protective panel 2, a framing element 1, an airspace 4, and carefully crafted venting means 5. Specifically, Fig. 1 shows a first modification of the preferred embodiment of the present invention which is a protective panel 2 over an ornamental window, such as a stained glass window 3, in a total frame 1a. An airspace 4 between said protective panel 2 and said stained glass window 3 is provided by the placement of the panel 2 and the window 3 in the total frame 1a. Venting means 5 will be described in full detail below.

The total frame 1a of the first modification of the preferred embodiment comprises side channels 6 and 7 for the panel 2 and ornamental window 3 to be inserted. It is not uncommon for total frame 1a to comprise an extruded aluminum frame, however, it is not so limited. Extruded aluminum frames often include a thermal barrier or thermo break 8 behind the airspace 4. The thermal break 8 can comprise polyurethane or any other suitable synthetic or natural insulating material and is adjacent to and abuts the back of the airspace 4.

In a second modification of the preferred embodiment, the protective panel 2 is mounted in a perimeter frame 1b. Said airspace 4 is provided by a separation 28 of said ornamental window 3 and the panel 2 which results the from placement of the perimeter frame 1b relative to a window frame 27. Venting means 5 are crafted according to specifications described more fully below.

In each modification, and shown best in Figs. 3-7, venting means 5 preferably comprise vent openings 50 and 51 which occur in pairs, one for entry (50) and one for

exit (51) of air thereby providing air flow through air space 4 in a directional manner. Entry vent openings 50 each further comprise a first path 54 and a first interior vent opening 52. In the preferred embodiment, said first path 54 comprises a first proximal path 55 and a first distal path 56 separated by a first inside opening 58 between said entry vent opening 50 and said first interior vent opening 52. Exit vent opening 51, in like fashion, comprises a second path 59 and a second interior vent opening 53 and, in the preferred embodiment, said second path 59 comprises a second proximal path 60 and a second distal path 61 separated by a second inside opening 62. Said first interior vent opening 52 is preferably above said entry vent opening 50 so that rain water does not pass from the entry vent opening 50 to the airspace 4. Air flow direction is dictated by the principle that heat rises drawing warm air upward. Placement of venting means 5 are preferably in vertical portions of frames 1a or 1b for aesthetic appeal as well as for maintaining the strength and integrity of the frames, however, placement in horizontal portions is also contemplated. It is contemplated that a debris deterring accessory 32 such as a screen, hood, or ceramic filter may be installed over said entry vent opening to deter entry of bugs and debris. Finally, there is no limit to the number of vent openings employed, however, it is recommended that there is an entry vent opening 50 present for every exit vent opening 51.

Said entry vent opening 50 has a first area , said exit vent opening 51 has a second area said first interior opening 52 has a third area and said second interior opening 53 has a fourth area. Said first path 54 has a first cross sectional area and said first proximal path 55 comprises a first proximal cross sectional area and said first distal path 56 includes a first distal cross sectional area. Said first inside opening 58 comprises a fifth area. Said

second path 59 comprises a second cross sectional area and said second proximal path 60 includes a second proximal cross section. Said second distal path 61 includes a second distal cross section and said second inside opening 62 comprises a sixth area.

To obtain adequate venting, it is recommended that said first area of the entry vent opening 50, said third area of the interior vent opening 52, and said first cross sectional area of the first path 54 are related as described below. This recommendation applies equally to the fourth area of the interior vent opening 53 and the second cross sectional area of the second path 59 and the second area of the exit vent opening 51.

Two simple principles provide guidelines as to the relative areas of vent openings. First, to provide adequate venting means, at least about 1 square inch of 100% effective opening to the air should be present for each about 2000 to 2500 square inches of the area of the ornamental window. Second, the first area of the entry vent 50, the first cross sectional area of the first path 54, and the area of the first interior vent 52 will provide adequate venting when they are related such that air flowing into said first path 54 is not constricted in its movement to the airspace 4. Expressed mathematically, this relationship can be understood as:

First area > or equal to first cross sectional area < or equal to third area; and

Fourth area > or equal to second cross sectional area < or equal to second area

It should also be understood that, depending on the positioning of said venting means, said first inside opening 58 and the fifth area may not be of equal dimension as said entry vent opening 50 and the first area. In that situation, the air must flow between said entry vent opening 50 and said interior vent opening 52 through said first inside opening 58. When this is the case, the fifth area (which is the area of said first inside

opening) should be equal to or greater than the first proximal cross sectional area and the first distal cross sectional area in order to meet the principle requiring no constriction. This same logic applies relative to said exit vent opening 51, said second interior vent opening 53, and said second inside opening 62.

If said entry vent 50 is provided deterring accessories such as screens, filters, or hoods, then the effectiveness of that opening will be reduced. For example, an entry vent with a screen may have an effective level of 66%. Therefore, a screened entry vent should be 1.67 times larger than one without in order to provide an equal amount of effective ventilation. Considering the equation above, then,

(effective 50a) = 66% X area of unobstructed opening

Venting means may be positioned directly in frame 1a or 1b by cutting said entry vent opening in a portion of said frame 1a or 1b, incorporating a normally hollow interior of said frame as said first path 54, and cutting said first interior vent 52 in same said frame such that said first interior vent 52 is open to said first path 54 and to said airspace 4 between said protective panel 2 and said ornamental window 3. It is contemplated that frame 1a or 1b may be of extruded aluminum but it is not so limited. Many frames of extruded aluminum include thermo breaks 8. In that case, said first path 54 would include said first inside opening 58 cut in said thermo break 8 to provide a way for air to move from said entry vent opening 50 through said first interior vent 52. A screen 33 may be added as a debris deterring accessory to said entry vent opening to provide protection from insects and debris. If needed, a second entry vent opening 50 may be closely and vertically spaced from said entry vent opening in order to achieve adequate venting and still maintain the structural integrity of said frame 1a or 1b. Finally, in some climates it

may be advisable to provide a hood 32 over said entry vent 50 to minimize inflow of rain. In addition, at least one dam member 70 can be installed above and below said entry vent opening 50 to provide upper and lower boundaries for said first path 54 in order to prevent said frame 1a or 1b from acting as a chimney drawing air up into the frame rather than through said first path 54 and out said first interior vent opening 52 to said airspace 4.

Venting means 5 is completed by positioning said exit vent opening 51 directly in said frame 1a or 1b vertically spaced apart from said entry vent opening 50. Said second interior opening 53 is positioned in said frame to allow inflow of air to said second path 59 and through said exit vent opening 51. Because of the direction of air flow through said exit vent opening 51, no dam member 70 is necessary.

Venting means 5 may instead be fully incorporated in two castings each having a closed top end 80. In this situation, a first casting 75 comprises an entry vent opening 50, a first path 54, and a first interior opening 52. Said closed top end 80 eliminates any need for said dam member 70 described above. Said screen 32 and said hood 33 may be employed with the same effect as described above. A second casting 76 comprising an exit vent opening 51, a second path 59, and a second interior opening 53 would be positioned above said first casting 75 and both said castings would be incorporated in said frame (See Fig. 8). The preferred recommended mathematical relationships between vent openings, areas and cross sections remains the same for effective venting and, as in the description above, if there is present said second inside opening or said first inside opening, the fifth and sixth areas should be considered in the equation relative to said first

and second proximal cross sections, respectively, and said first and second distal cross sections, respectively.

Referring now to Figs. 9 and 10, many ornamental windows and their frames have a gothic top portion 90 with an apex 92, or rounded 94 top portions. The venting means 5 of the present invention can be employed to provide adequate venting for windows with these characteristics as well. In these constructions, at least one said entry vent opening 50 is positioned in a lower portion of said gothic top portion 90 or said rounded top portion 94. In said gothic top portion 90, at least one exit vent opening 51 is placed near said apex 92 which typically results in a 30 degree angle with horizontal. Said exit vent opening 51 is of slightly narrower proportions than those previously discussed and is cut from an outermost edge of said frame. This orientation allows said venting means 5 to function essentially as horizontal venting means. In said round top version, at least one exit vent opening 51 is placed near an uppermost curved portion. In either a round top or gothic top installation said frames have an interior surface. At least one weep hole 96 is positioned above and proximal to said entry vent 51 and said interior surface is wetted to assist in directing any water that enters down to said weep hole 96. The mathematical relationship of areas of openings and cross sections in round top and gothic top windows should also follow the rationale described above.

The material used in frame 1a or 1b is typically aluminum, but is not so limited and can be made of other types of synthetic or natural material which minimize maintenance problems and are easily installed. Extruded aluminum frames such as that pictured in Figs. 1 and 2 are most commonly used because of the ease of installation and durability. Wood frames are, however, also used. The protective panel 2 that is employed

may also be selected from a wide variety of transparent materials such as glass, including tempered, laminated or thermopane glass, such as double or triple glazed units. Synthetic materials suitable for use as a protective panel in the present invention include acrylic, or polycarbonate panels. The present invention is not intended to be limited by the specific material used for either the frame or protective panel. Finally, the air exchange facilitated by venting means of the present invention is not limited to exchange with air exterior to the building in which the window is installed. The exchange may be with air interior to the building which, in some climates such as the southernmost United States, is more advantageous for managing moisture and heat damage.

Thus, the present invention has been described in an illustrative manner. It is to be understood that the terminology that has been used is intended to be in the nature of words of description rather than of limitation.

Many modifications and variations of the present invention are possible in light of the above teachings and some have been presented herein. Therefore, within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described.